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(19)

(54) TELESCOPIC BOOM

(71) We, A/S NORMAR, a Company incorporated in accordance with Norwegian law, of Kongensgt. 15, Oslo 1, Norway, do hereby declare this invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a telescopic boom.

In known telescopic booms, hydraulic cylinders are mostly used for the extension and retraction of the boom. For this purpose, each telescope section may have a hydraulic cylinder housed therein or a cylinder common to all of the telescope sections may be provided.

These known telescopic booms, due to the different effective cylinder areas of the several boom sections thereof suffer from the disadvantage that the pushing force and pulling forces are not equal.

According to the present invention, there is provided a telescopic boom comprising a first boom section which is arranged to be mounted at or near one end thereof on a stationary support so as to be longitudinally non-displaceable with respect thereto, a second boom section supported by the first boom section for longitudinal movement with respect to said first boom section and a third boom section supported by the second boom section for longitudinal movement with respect to said second boom section, said telescopic boom being provided with a power transmission mechanism for extending and retracting the second boom section with respect to the first boom section and the third boom section, wherein said power transmission mechanism includes a pinion mounted for rotation about an axis located in a fixed position with respect to the first boom section and meshing with a rack fixed to and extending longitudinally of the second boom section, a gear wheel rotatably mounted in the end part of the second boom section which is nearer to the said one end of the first boom section and meshing with a rack fixed to and extending longitudinally of the first boom section, a drive sprocket fixed for rotation with the gear wheel a chain passing round said drive sprocket and round an idler sprocket rotatably mounted in the end part of the second boom section which is farther from the said one end of the first boom section and drivably connected to the third boom section, said pinion being rotatable by an outside power source so as to effect longitudinal displacement of the second boom section with respect to the first boom section, by driving the rack fixed to the second boom section, and thereby to effect simultaneous longitudinal displacement of the third boom section with respect to the second boom section by the chain connected to the third boom section being driven by the drive sprocket as a result of the gear wheel being rotated by movement thereof along the rack fixed to the first boom section during longitudinal displacement of the second boom section with respect to the first boom section.

The telescopic boom according to the invention provides, when in use, a uniform pushing force outwardly and the same pulling force inwardly and for any given constructional dimensions, has a larger capacity than known telescopic booms in which all the boom sections are driven hydraulically.

The invention will now be described in further detail, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a side view, partly in section and partly broken away, of a telescopic boom embodying the invention comprising two extensible and retractable boom sections,

Figure 2 is a top plan view of the telescopic boom of Figure 1,

Figure 3 is a view, mainly in horizontal section, but partly in plan, of the telescopic boom of Figure 1, and

Figure 4 is a view similar to Figure 3 of a

telescopic boom having an additional boom section.

In Figures 1 to 3, the reference numeral 1 designates a substantially round base unit housing driving means for rotating an annular disc 2. The reference numeral 3 designates a first boom section in the form of a housing which is fixed to the disc 2 and can be swung horizontally together with the disc 2. If desired, the base unit may take such a form that a hoisting and lowering motion may be imparted to the housing 3.

In the housing 3, which is constructed substantially as a rectangular section tube, there is provided a second boom section 4 of substantially the same cross-sectional shape as the housing 3, i.e. having four walls which define a substantially rectangular section tube, but having dimensions which permit it to travel telescopically out of and into the housing 3 with suitable play. The second boom section 4 is supported on a plurality of guide pieces 5 attached to the inner wall surfaces of the housing 3. On the outside of its upper wall, the second boom section 4 carries a longitudinal rack 6, which is in engagement with a drive pinion 7 mounted on a shaft 8 outside the housing 3. The shaft 8 of the pinion 7 is supported at its free end in a bearing 9 and is connected at the driving end to a hydraulic coupling 10 driven by a hydraulic motor 11. The hydraulic coupling 10 and the hydraulic motor 11 receive hydraulic fluid under pressure transferred from an oil supply (not shown) via pipes 12 and 13, respectively. The part of the pinion 7 engaging the rack 6 on the section 4 protrudes through an opening 14 in the upper part of the housing 3.

During operation of the motor 11, the second boom section 4 will, dependent on the sense of rotation of the motor shaft, be pushed out of the housing 3 or pulled into it. Concurrently with the movement of the second boom section 4, a third boom section 15, which is mounted in the second boom section 4, will be moved relatively to the latter in the following manner.

The movement of the third boom section 15 relatively to the section 4 is primarily brought about by means of a gear wheel 16 fixed to a shaft 17 which is rotatably mounted in the inner end part of the second boom section 4. A portion of the gear wheel 16 protrudes through an opening 18 in the second boom section 4 and is in engagement with a rack 19 provided on the inside of the bottom portion of the housing 3. Mounted on opposite end parts of the shaft 17 are sprocket wheels 20 and 21 respectively. Two chains 22 and 23 pass round the sprocket wheels 20 and 21 respectively and round further sprocket wheels 24 and 25 respectively which are rotatably mounted inside of the outer end of the second boom section 4. In Figure 3 the bearings of the sprocket wheels 24 and 25 are indicated at 26 and 27 respectively.

The chains 22 and 23 are connected to the third boom section 15 by connecting means 28 and 29 respectively. When the gear wheel 16 engaging the rack 19 is rotating, due to relative movement of the section 4 and the housing 3 consequent to the gear wheel 7 being driven, the chains 22 and 23 will displace the third boom section 15 with respect to the second boom section 4, so as to impart a telescopic extension or retraction to the boom.

In a similar manner as the second boom section 4, the third boom section 15 is supported by guide pieces 30 provided on the inside of the second boom section 4. At the outer end of the second boom section 4 there are also provided guide rollers bearing on the third boom section 15.

The telescopic boom shown in Figure 4 differs from that shown in Figures 1 to 3 in that it has a fourth boom section 32 which is guided for telescopic sliding movement with respect to the third boom section 15 and is provided with means for extending and retracting it with respect to the latter. In Figure 4, those parts of the telescope boom shown therein which correspond to parts of the telescopic boom shown in Figures 1 to 3 are designated by the same reference numerals as those used to designate the last-mentioned parts.

In the second boom section 4 shown in Figure 4, in addition to the parts already mentioned, there is provided a longitudinal rack 33 which extends from the area of the gear wheel 16 to the front end of this second boom section. A pinion 34 fixed on a shaft 35, which is rotatably mounted in the inner end of the third boom section 15, is in engagement with the rack 33. A portion of the gear wheel 34 protrudes through an opening 36 in the lower portion of the third boom section 15 and on opposite end parts of the shaft 35 there are mounted sprocket wheels 37 and 38 respectively. Around the sprocket wheels 37 and 38 there are passed chains 39 and 40 respectively. The chain 39 also passes round a sprocket wheel 41 fixed to a shaft mounted in the outer end part of the third boom section 15 adjacent one side of the latter and the chain 40 similarly passes round a second sprocket wheel 42 fixed to the same shaft adjacent the opposite side of the outer end part of the third boom section 15.

The chains 39 and 40 are connected to the fourth boom section 32 by connecting means 43 and 44 respectively. When the pinion 34 which is in engagement with the rack 33 is rotating due to the relative motion of sections 15 and 4, as explained above in connection with Figures 1 to 3, the chains 39 and 40 will displace the fourth boom section 32 with respect to the third boom section 15 so as to give the boom an additional telescopic extension or retraction.

In a similar manner as the second and third boom sections 4 and 15, the fourth boom

section 32 is supported by guide pieces 45 provided on the inside of the third boom section 15. Also in the embodiment of Figure 4, at the outer end of the third boom section 15, there are provided guide rollers 46 bearing against the fourth boom section 32 and serving for a further stabilization of the same when it is in the fully extended position.

It is to be understood that the telescopic booms described above can be expanded to comprise more than three telescopically movable boom sections depending on the application for which the boom is designed.

It is further to be understood that the embodiments described above can also be combined with boom sections which are displaced in a boom section located outside thereof by means of hydraulic cylinders. Such a combination may be advantageous when a gripping head, which also works with hydraulic pressure, is mounted at the end of the outermost boom section.

WHAT WE CLAIM IS:—

1. A telescopic boom comprising a first boom section which is arranged to be mounted at or near one end thereof on a stationary support so as to be longitudinally non-displaceable with respect thereto, a second boom section supported by the first boom section for longitudinal movement with respect to said first boom section and a third boom section supported by the second boom section for longitudinal movement with respect to said second boom section, said telescopic boom being provided with a power transmission mechanism for extending and retracting the second boom section with respect to the first boom section and the third boom section with respect to the second boom section, wherein said power transmission mechanism includes a pinion mounted for rotation about an axis located in a fixed position with respect to the first boom section and meshing with a rack fixed to and extending longitudinally of the second boom section, a gear wheel rotatably mounted in the end part of the second boom section which is nearer to the said one end of the first boom section and meshing with a rack fixed to and extending longitudinally of the first boom section, a drive sprocket fixed for rotation with the gear wheel and a chain passing round said drive sprocket and round an idler sprocket rotatably mounted in the end part of the second boom section which is farther from the said one end of the first boom section and drivably connected to the third boom section, said pinion being rotatable by an outside power source so as to effect longitudinal displacement of the second boom section with respect to the first boom section, by driving the rack fixed to the second boom section, and thereby to effect simultaneous longitudinal displacement of the third boom section with respect to the second boom section by the chain connected to the third boom section being driven by the drive sprocket as a result of the gear wheel being rotated by movement thereof along the rack fixed to the first boom section during longitudinal displacement of the second boom section with respect to the first boom section.

2. A telescopic boom as claimed in claim 1, wherein the third boom section supports a fourth boom section for longitudinal movement with respect to the third boom section and the power transmission mechanism includes transmission means having an input arranged to be driven by longitudinal movement of the third boom section with respect to the second boom section and an output drivably connected to the fourth boom section so that longitudinal movement of the third boom section with respect to the second boom section will produce longitudinal movement of the fourth boom section with respect to the third boom section simultaneously and in the same longitudinal direction.

3. A telescopic boom as claimed in claim 2, wherein said transmission means includes a further gear wheel rotatably mounted in the end part of the third boom section which is nearer to the said one end of said first boom section and meshing with a further rack fixed to and extending longitudinally of the second boom section, a further drive sprocket fixed for rotation with said further gear wheel and a further chain passing round said further sprocket and round a further idler sprocket mounted in the end part of the third boom section which is farther from said one end of the first boom section, so that longitudinal displacement of the third boom section with respect to the second boom section will produce longitudinal movement of the fourth boom section with respect to the third boom section simultaneously and in the same longitudinal direction due to the further chain connected to the fourth boom section being driven from the further drive sprocket as a result of the further gear wheel being rotated by movement thereof along the further rack fixed to the second boom section during longitudinal movement of the third boom section with respect to the second boom section.

4. A telescopic boom as claimed in claim 2, wherein said transmission means is hydraulically operated.

5. A telescopic boom as claimed in any of the preceding claims, wherein the first boom section is provided at or near the said one end with means for mounting it on a stationary support for horizontal swivelling movement.

6. A telescopic boom as claimed in any of the preceding claims, wherein each of the boom sections has the form of a rectangular section tube and wherein the pinion is fixed on a shaft located outside the first boom section and projects through an opening in a wall part of the first boom section and the rack with which the pinion meshes is fixed to the outside of the adjacent wall part of the second boom section and wherein the gear wheel is fixed on a shaft

rotatably mounted in two opposite side walls of the second boom section and projects through an opening in a third wall of the latter and the rack with which the gear wheel meshes is fixed to the inside of a wall part of the first boom section, which wall part is adjacent the third wall of the second boom section.

7. A telescopic boom substantially as described with reference to and as shown in Figures 1 to 3 or Figure 4 of the accompanying drawings.

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1550072 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

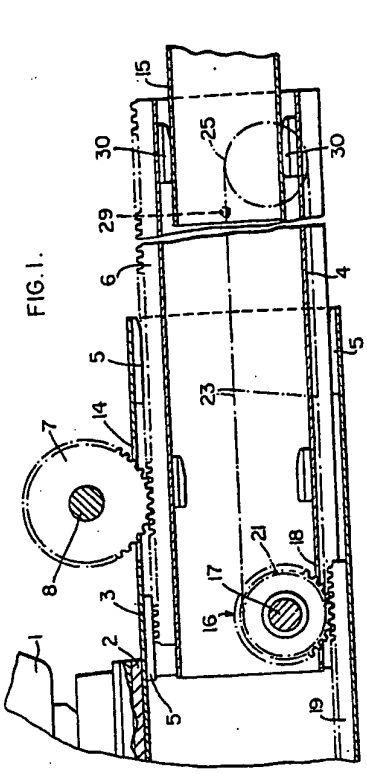

FIG. 1.

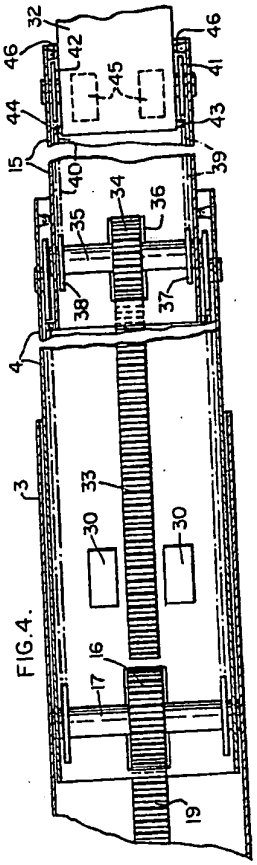

FIG. 4.

1550072 COMPLETE SPECIFICATION

2 SHEETS This drawing is a reproduction of the Original on a reduced scale

Sheet 2

FIG.2.

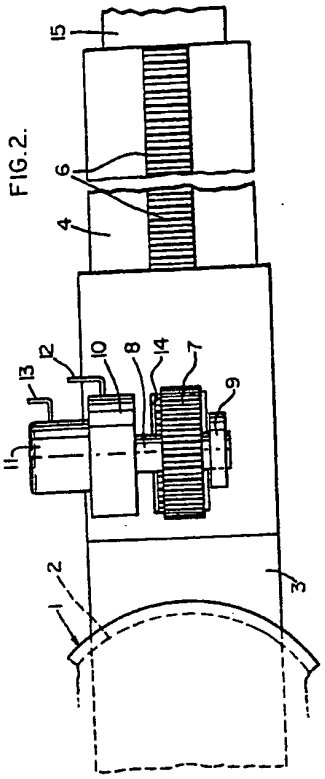

FIG.3.